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Sensing activity of cholinesterases through a luminescence response of the hexarhenium cluster complex [{Re6S8}(OH)6]$^{4-}$

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Abstract

© 2016 The Royal Society of Chemistry.The present work describes a new method to sense cholinesterase-catalyzed hydrolysis of acetylcholine (ACh) through a luminescence response of the hexarhenium cluster complex [{Re6S8}(OH)6]4-. A proton released from acetylcholinesterase (AChE)- or butyrylcholinesterase (BuChE)-catalyzed hydrolysis of ACh results in time-resolved sensitization of cluster-centered luminescence. The sensitization results from protonation of apical hydroxo-groups of the cluster complex. The protonation is affected by a counter ion effect. Thus, optimal conditions for adequate sensing of acetic acid produced by ACh hydrolysis are highlighted. Time-resolved luminescence and pH measurements under conditions of AChE-catalyzed hydrolysis of ACh show a good correlation between the cluster-centered luminescence and pH-induced inhibition of AChE. The inhibition is not significant within the first two minutes of ACh hydrolysis. Thus, the luminescence response measured within two minutes is dependent on both substrate and enzyme concentrations, which fits with AChE and BuChE kinetics. The usability of cluster-centered luminescence for monitoring the concentration-dependent inhibition of AChE with irreversible inhibitors is demonstrated, using a carbamylating agent, pyridostigmine bromide, as a model.

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